US Army Corps of Engineers®
Engineer Research and Development Center

Plant Growth Simulation Models

Technology

The ERDC Environmental Laboratory has developed several simulation models that managers of aquatic and terrestrial systems can use to assess the biomass dynamics of plants. Currently four models for submersed plants are available (hydrilla, Eurasian watermilfoil, American wildcelery, and Sago pondweed). These models are all based on carbon flow through the vegetation in a meter-squared water column. The models include descriptions of several factors that affect biomass dynamics, such as site-characteristic changes in climate, water temperature, water transparency, water level, pH, wintering strategies, mechanical control, and climate. The user can easily modify the plant community and site characteristics. Reports, user manuals, and executables can be downloaded via the Internet at: http://el.erdc.usace.army.mil/products.cfm?Topic=model&Type=aquatic

Problem

Plants play important roles in ecosystems, as primary producers and sources of food and habitat. The degree to which plants influence their environment is proportional to mass, and depends on species and physical and chemical factors. The U.S. Army Corps of Engineers is responsible for the operation and management of large freshwater bodies and for terrestrial systems used for military training. These systems are used for multiple purposes and their sound management depends upon quantitative evaluations of the beneficial effects of vegetation in counteracting environment-degrading, man-induced impacts. ERDC-EL has developed plant growth simulation models to predict the biomass dynamics of a number of plants.

Expected Cost To Implement

The submersed plant models for hydrilla, Eurasian watermilfoil, American wildcelery, and Sago pondweed are available online at http://el.erdc.usace.army.mil/products.cfm?Topic=model&Type=aquatic. Users incur costs only in discretionary time spent using the models. The models run on computer setups that are readily available, i.e., IBM-compatible personal computer with Pentium processor and Microsoft Windows 95 and higher family with mouse support.

Benefits/Savings

Simulation models for the metabolism and growth of aquatic and terrestrial plants are useful tools in managing the large freshwater bodies and military training systems that are the responsibility of the U.S. Army Corps of Engineers. Users can save significant amounts of time and money by using plant growth simulation models to promote sound management of these systems.

Status

Currently, four simulation models for the biomass dynamics of plants have been developed at ERDC-EL: hydrilla, Eurasian watermilfoil, American wildcelery, and Sago pondweed. These models are available at: http://el.erdc.usace.army.mil/products.cfm?Topic=model&Type=aquatic. ERDC-EL will use the same concepts to develop models for terrestrial vegetation.

ERDC POC Dr. Elly Best, 601-634-3641, Elly.P.Best@usace.army.mil

Distribution Sources Both Corps users and the public can access the plant growth simulation models developed by ERDC-EL at

http://el.erdc.usace.army.mil/products.cfm?Topic=model&Type=aquatic

Available Documentation

Hydrilla: Best, E. P. H., and Boyd, W. A. (1996). "A simulation model for growth of the submersed aquatic macrophyte hydrilla (*Hydrilla verticillata* (L. F.) Royle)," Technical Report A-96-8, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Boyd, W. A., and Best, E. P. H. (1996). "HYDRIL (Version 1.0): A simulation model for growth of *Hydrilla*," Instruction Report A-96-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Eurasian watermilfoil: Best, E. P. H., and Boyd, W. A. (1999). "A simulation model for growth of the submersed aquatic macrophyte Eurasian watermilfoil (*Myriophyllum spicatum* L.)," Technical Report A-99-3, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Best, E. P. H., and Boyd, W. (1999). "MILFO (Version 1.0): A Simulation Model for Growth of Eurasian Watermilfoil-User's guide," Instruction Report A-99-1, US Army Engineer Research and Development Center, Vicksburg, MS.

American wildcelery: Best, E. P. H., and Boyd, W. A. (2001). "A Simulation Model for Growth of the Submersed Aquatic Macrophyte American Wildcelery (Vallisneria americana Michx.)," ERDC/EL TR-01-5, U. S. Army Engineer Research and Development Center, Vicksburg, MS.

Ashby, S. L., Martin, W. D., and Gaines, Ca. N. (2001). "Water Quality and Potential Sediment Erosion Assessment for Proposed Construction at Fort Knox, Kentucky," ERDC SR-01-1, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Sago pondweed: Best, E. P. H., and Boyd, W. A. (2003). "A Simulation Model for Growth of the Submersed Aquatic Macrophyte Sago Pondweed (*Potamogeton pectinatus* L.)," ERDC/EL TR-03-6, U. S. Army Engineer Research and Development Center, Vicksburg, MS.

Best, E. P. H., and Boyd, W. A. (2003). "POTAM (Version 1.0): A Simulation Model for Growth of Sago Pondweed," ERDC/EL SR-03-1, U. S. Army Engineer Research and Development Center, Vicksburg, MS.

General: Best, E.P.H., and Boyd, W.A., 2007. Carbon flow-based modeling of ecophysiological processes and biomass dynamics of submersed aquatic plants. ERDC/EL TR 07-14, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Best, E.P.H., and Boyd, W.A. (2007). “Expanded simulation models (Version 3.0) for growth of submersed aquatic plants Hydrilla, Eurasian watermilfoil, American wildcelery, and sago pondweed,” ERDC TN-SWRRP-07-10.

Best, E.P.H., Teeter, A.M., Landwehr, K.J., James, W.F., and Nair, S.K (2007). “Exploring restoration options for potential persistence of submersed aquatic vegetation in Peoria Lake, IL, using a combined ecological, hydrodynamics and sediment transport modeling approach,” Freshwater Biology 53: 814-826.

Available Training No training is necessary or offered (see Available Support below).

Available Support The plant growth simulation models developed by ERDC-EL are user-friendly; however, if users experience problems in using the models, they are asked to contact Dr. Elly Best (601-634-4246).